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The Support of Multimedia SIP Applications Over a Proactive MANET Using Cross-Layering Design

DESCRIPTION

A general problem when deploying services in a MANET, is that the service location issue requires specific considerations due to dynamic network topology changes.

SOLUTION

We apply a cross-layer design approach to advertise SIP proxy and SIP User Agent server location information in a unified mechanism embedded in a proactive link-state routing protocol.
Our proposal can differentiate the SIP proxy server and SIP User Agent server (UAS) in the location information advertisement and can thus support both proxy-based and proxy-less SIP MANET network architectures in one unified server location distribution mechanism.

We explore and address cases where a proactive protocol is used to advertise the SIP server locations.
The Optimized Link State Routing (OLSR) protocol is given as an example. A new OLSR message type called the Service Location Extension (SLE) is defined for advertising the SIP server location. SLE messages within the MANET are propagated via OLSR message propagation and processing mechanism that uses MultiPoint Relay (MPRs) nodes.
When advertising a SIP server, SLE allows not only for the selection of server types, but also for other service attributes of SIP such as the supported and preferred transport layer protocols and security options.

Report Documentation Page

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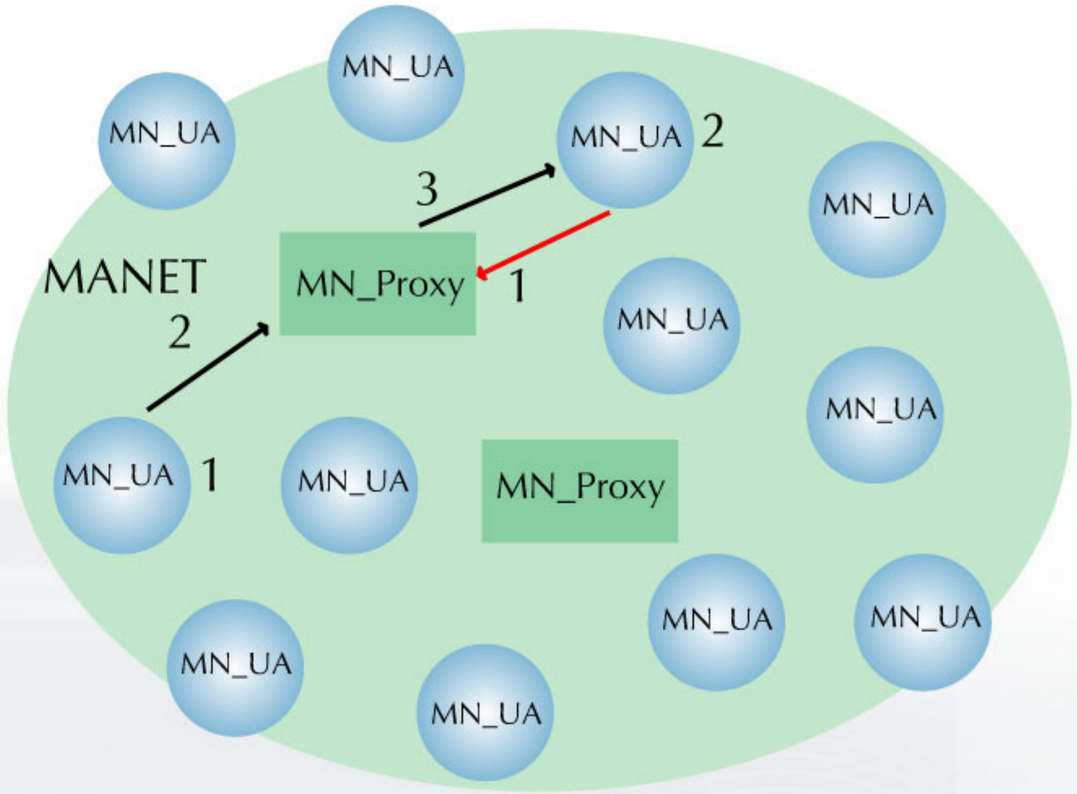
Proxy Server Based Networking Architecture

DESCRIPTION

In a proxy server based architecture, the location of the proxy server needs to be discovered by the UA nodes

Multiple proxy capable nodes may need to be maintained, to handle situations where the proxy server becomes unavailable due to the dynamic network change.

A weight parameter is defined to improve robustness when multiple proxy capable nodes are available in the MANET. A new proxy server can be selected with a minimum delay when the one in charge goes out of service.



- 1: register
- 2: send INVITE request
- 3. route the INVITE request to the called UA

MN_Proxy: MANET Node that has SIP Proxy capability
MN_UA: MANET node that has SIP UA capability

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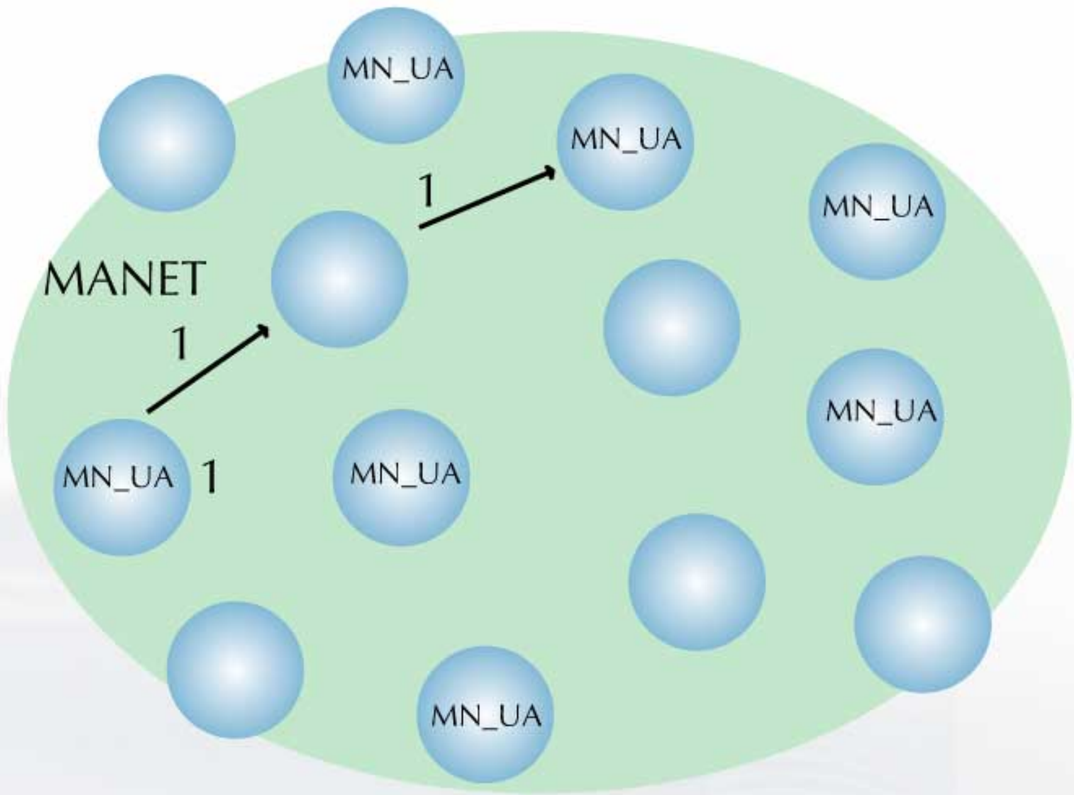
Fully Distributed Proxy-less Networking Architecture

DESCRIPTION

In the fully distributed architecture, the location of the called SIP UA needs to be discovered by the caller node

The address mapping function of the proxy server is distributed to each of the UA node.

Determining the IP address o f a called party (SIP UAS) is required at the caller (SIP UAC)



- 1: send INVITE request to the called UA

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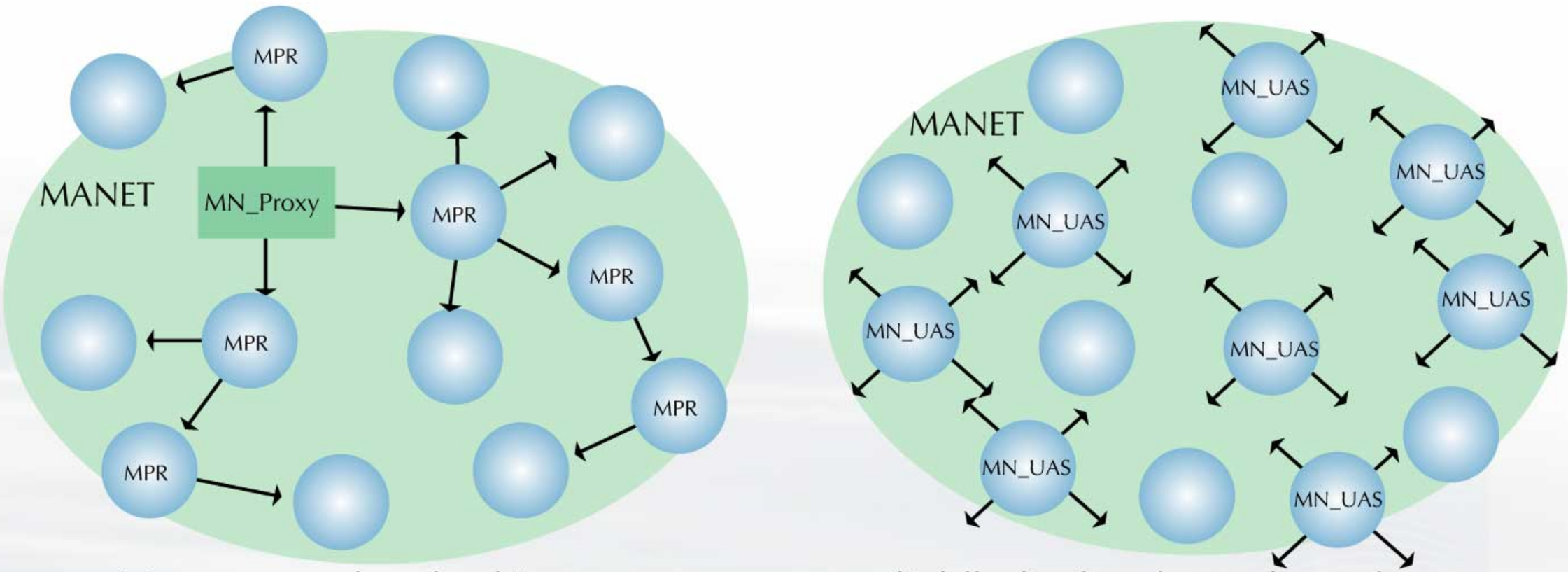
SIP Server Advertising Scheme using OLSR



(a) proxy-server based architecture

(b) fully distributed proxy-less architecture

A new OLSR Message type SLE is generated by either a proxy server or UAS, and forwarded through the MPRs

The SLE refresh timer can be set fairly long to mitigate the SLE message overhead

Cross-layering between the application and OLSR routing reduces network overhead

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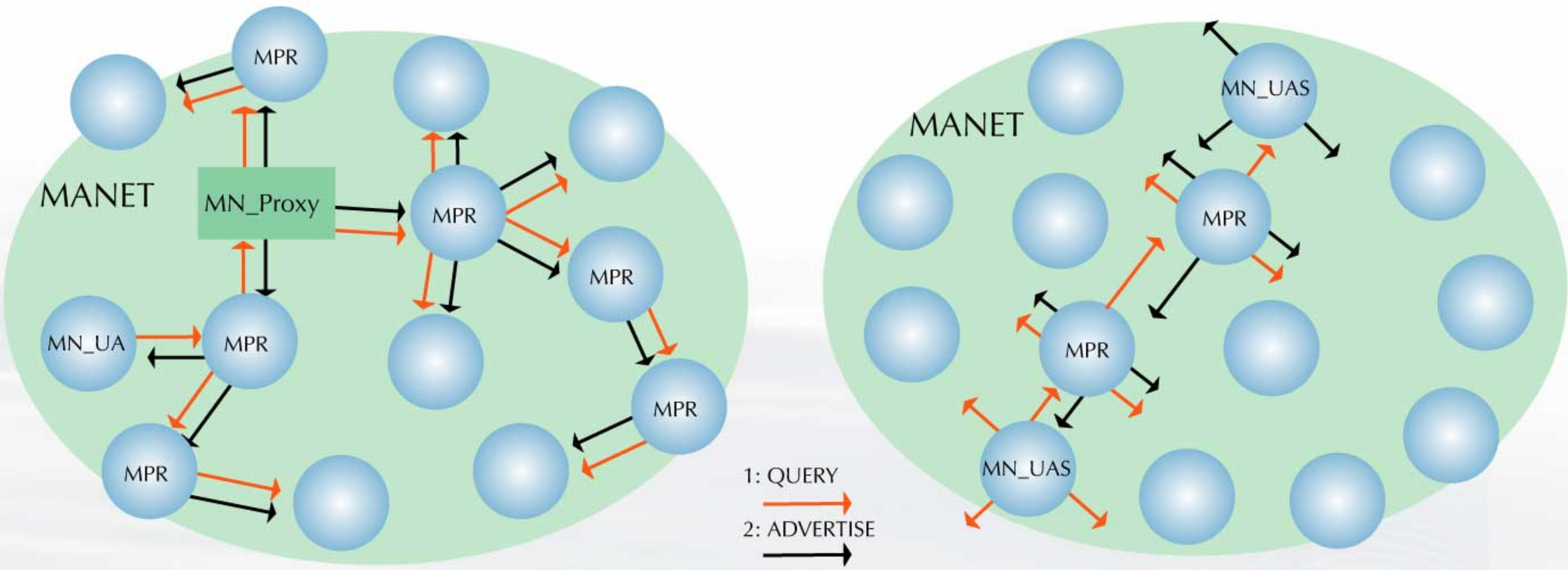
Server Advertising with Client Query Capability using OLSR



(a) proxy-server based architecture

(b) fully distributed proxy-less architecture

SLE can carry server queries propagated through the MPRs

The requested server(s) would respond by advertising their location(s)

Servers still advertise periodically though the refresh timer can be extended

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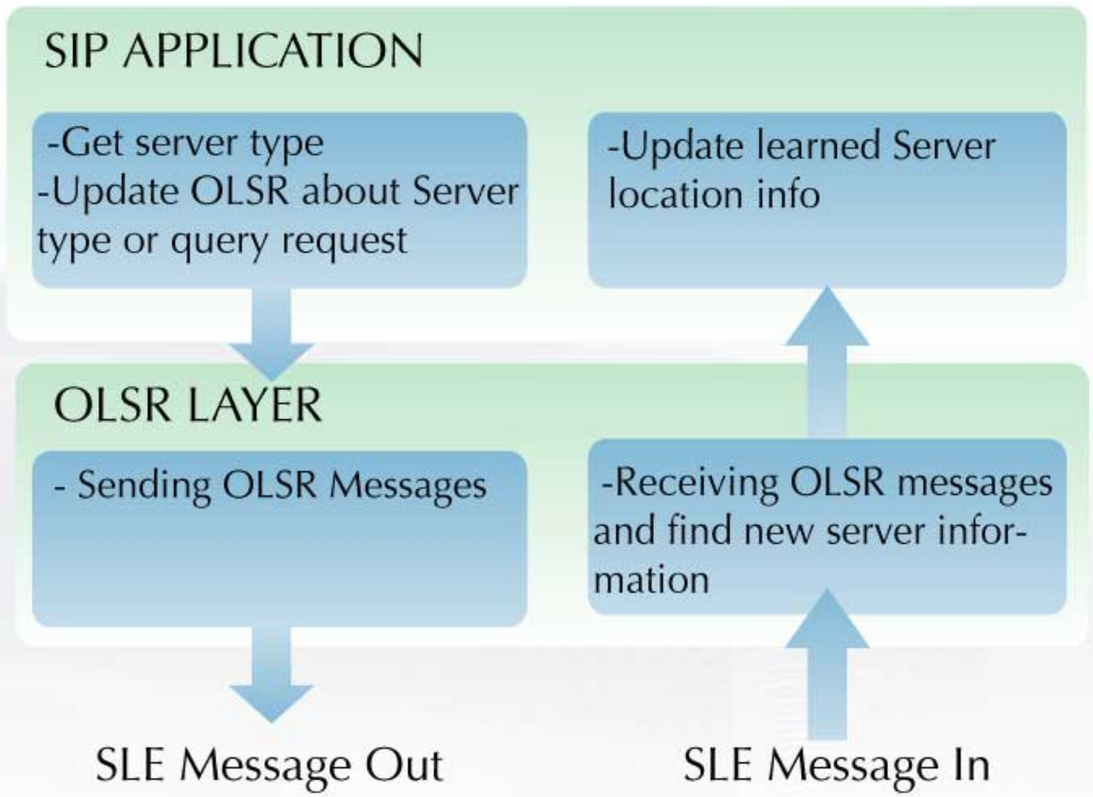
Cross-Layer Design: Between Application and Networking Layers

DEFINITION

Application layer owns the service information semantics

OLSR owns the messaging mechanism without knowing the semantics of the service related contents

Service information sequence number allows OLSR to differentiate new and old service information



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Performance Results and Conclusion

PROS AND CONS: PROXY-BASED APPROACH

The proxy server based SIP MANET architecture performs slightly better in terms of control message overhead, call setup latency and voice packet delivery ratio

The proxy server based SIP MANET may experience a call setup bottleneck that results in lower call setup success ratio. Multiple proxy servers may be required in this case.

In scenarios where the MANET movement is well organized to ensure that the proxy server(s) maintain a centralized location in the topology (e.g., in an organized military MANET) the proxy server based architecture may be favored.

PROS AND CONS: PROXY-LESS APPROACH

The fully distributed proxy-less SIP MANET architecture delivers comparable voice service performance and is not concerned with the location and connectivity of the proxy servers.
The fully distributed architecture may be more suitable for a dynamic SIP MANET scenario.

CONCLUSION

Cross-layer support of service discovery utilizing the OLSR protocol demonstrates implementation and architecture efficacy. The OLSR message overhead generated by SLE is very limited.

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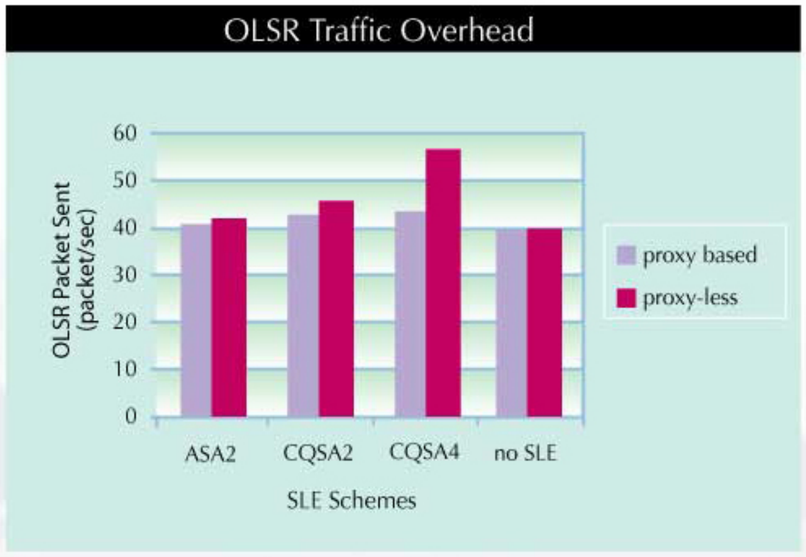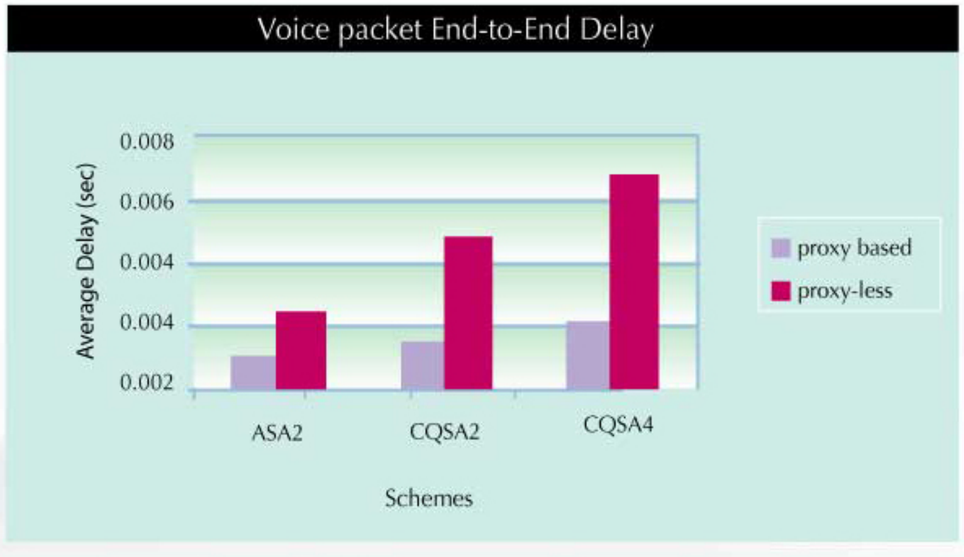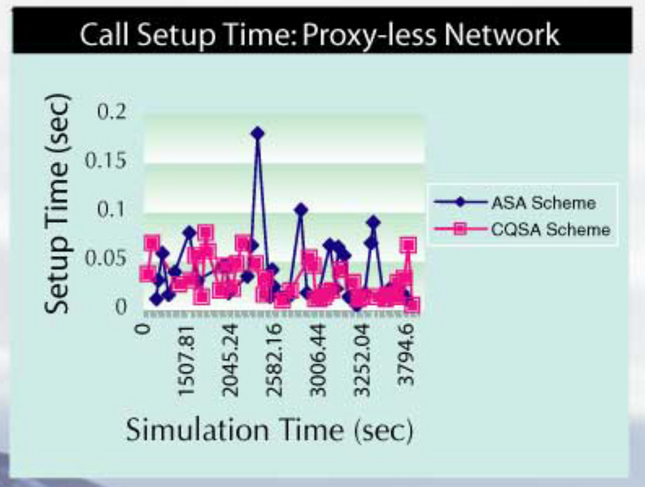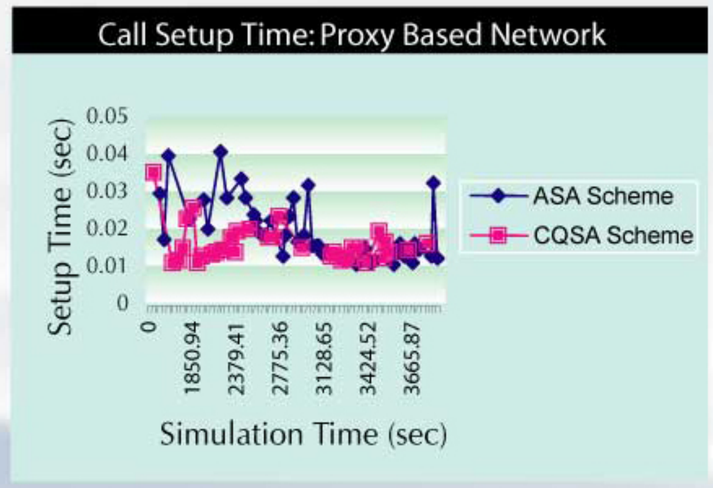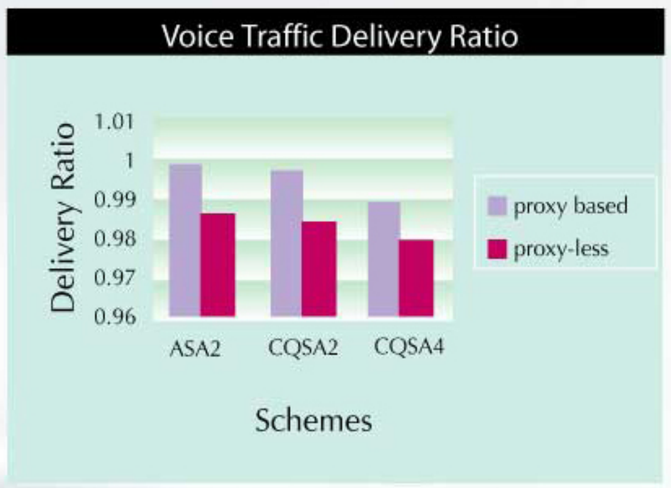
Performance Results